

Communication

The nutrient composition of the herbicide-tolerant green pepper is equivalent to that of the conventional green pepper

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Abstract

One important aspect of assessing the safety of genetically modified (GM) crops for human consumption is the characterization of their nutrient composition. This study was conducted to compare the nutritional components between the GM herbicide-tolerant green peppers and the conventional green peppers. The proximate components (energy, moisture, protein, fat, fiber, ash, and carbohydrates) and minerals (calcium, phosphorus, iron, sodium, potassium, magnesium, and zinc) were analyzed in their pericarps and seeds with placentas according to the methods established by the Association of Official Analytical Chemists. Our study demonstrates that there is no significant difference between the GM herbicide-tolerant and the conventional green peppers in their nutrient contents as measured in this study.

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Genetically modified crops; Herbicide-tolerance; Green pepper; Nutrients; Substantial equivalence

1. Introduction

Genetically modified (GM) crops are becoming an increasingly important part of the common food supply. The global supply of transgenic crops increased 40-fold in the past decade [1]. With increasing production of GM crops, consumers' concern about the safety of GM products is rising [2]. One important aspect in assessing the safety of GM crops for human consumption is the characterization of their nutrient composition in the host plant or in its close relatives [3]. Green pepper is one of the main spices and food additives consumed by Koreans [4]. This study was carried out to investigate the effects of genetic changes in green pepper on its nutrient composition.

2. Methods and materials**2.1. Materials**

The herbicide-tolerant (HT) green peppers and its genetically unmodified control (CT) were obtained from the National Institute of Agricultural Biotechnology in Korea. The development of herbicide resistance in normally herbicide-susceptible green peppers involves adding phosphinothricin acetyltransferase gene using *Agrobacterium*-mediated transformation [5]. The nutrient contents of pericarps and seeds with placentas were determined as described in the analytical procedures.

2.2. Analytical procedures

Both conventional green pepper and its genetically modified counterpart were analyzed for their proximate nutrient (energy, moisture, protein, fat, fiber, ash, and carbohydrates) and mineral (calcium, phosphorus, iron, sodium, potassium, magnesium, and zinc) contents according to

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Table 1

Comparison of the nutrient composition between CT and HT green peppers (per 100 g edible portion)

Nutrients	Pericarps		Seeds with placentas	
	CT	HT	CT	HT
Energy (kJ)	123.01 ± 0.84	122.59 ± 2.93	276.56 ± 7.95	285.76 ± 7.53
Moisture (%)	88.90 ± 0.20	88.20 ± 0.20	71.30 ± 1.00	73.50 ± 0.40
Protein (g)	1.57 ± 0.14	1.69 ± 0.07	6.66 ± 0.13	6.65 ± 0.18
Fat (g)	0.14 ± 0.08	0.15 ± 0.06	4.14 ± 0.13	4.14 ± 0.22
Fiber (g)	2.06 ± 0.11	2.44 ± 0.10	8.17 ± 1.13	9.43 ± 0.10
Ash (g)	0.88 ± 0.04	0.84 ± 0.01	1.36 ± 0.05	1.39 ± 0.06
Carbohydrate (g)	6.62 ± 0.03	6.69 ± 0.26	4.22 ± 0.77	4.88 ± 0.80
Calcium (mg)	10.40 ± 0.40	9.40 ± 0.20	8.80 ± 0.80	10.10 ± 0.30
Phosphorus (mg)	42.60 ± 0.30	43.40 ± 1.40	177.3 ± 4.90	171.10 ± 2.10
Iron (mg)	0.89 ± 0.15	1.01 ± 0.14	2.63 ± 2.04	2.62 ± 0.12
Sodium (mg)	2.86 ± 0.04	3.25 ± 0.40	3.30 ± 0.22	3.56 ± 0.42
Potassium (mg)	455.20 ± 22.2	449.80 ± 27.5	585.50 ± 17.0	604.50 ± 33.9
Magnesium (mg)	23.90 ± 0.90	24.20 ± 0.70	100.40 ± 11.1	98.40 ± 1.10
Zinc (mg)	0.27 ± 0.03	0.29 ± 0.04	0.90 ± 0.08	0.91 ± 0.02

Data are means ± SE (n = 3). There was no significant difference between CT and HT green peppers ($P > .05$).

the methods of the Association of Official Analytical Chemists [6].

2.3. Statistical analysis

All measurements were carried out in triplicate. Means ± SE values were analyzed by the procedure of Scheffe test using the SPSS program v. 10.0 for Windows (SPSS, Chicago, Ill), and statistical significance was assumed at a probability value of $P < .05$.

3. Results

3.1. Proximate nutrients

Proximate analysis is the standard method for determining the base chemical composition of GM crops [7]. As can be seen in Table 1, there was no significant difference in the energy and the protein levels of pericarps and seeds with placentas between HT and CT green peppers. The levels of moisture, fat, fiber, ash, and carbohydrates in pericarps and seeds with placentas were also similar between HT and CT green peppers. Moreover, the protein contents of HT pericarps and seeds with placentas were within the range of those of the conventional green peppers [8,9].

3.2. Minerals

As can be seen in Table 1, there was no significant difference in the content of minerals (calcium, phosphorus, iron, sodium, potassium, magnesium, and zinc) in the pericarps and in the seeds with placentas between HT and CT green peppers.

4. Discussion

The proposed approach for the assessment of food safety starts with the comparison of the new GM crop with a traditional counterpart that is generally accepted as safe [2]. Any significant reduction or increase should be noted based,

in part, on proximate and mineral contents resulting from the potential inhibition and promotion of nutrient synthesis as a result of the application of herbicide resistance [3]. This study showed that the proximate and the mineral compositions of HT green peppers are similar to those of conventional green peppers. The contents of vitamins/provitamins β -carotene, thiamin, riboflavin, and ascorbic acid were similar between conventional and HT green peppers [10]. The level of phytate, known as an antinutrient and tumor cell-suppressing factor [11], was similar (7.7–8.0 mg/g) in the seeds with placentas between HT and its CT green peppers [12]. Although the level of phytate in pericarps was very small, there was no significant difference in phytate content between the conventional and GM green peppers. No deleterious effect was found in the pericarps and seed with placentas between GM and the conventional green pepper.

In summary, the nutrient composition of the GM HT green peppers developed by RDA was found to be substantially equivalent to that of the conventional intact green peppers that were normally susceptible to herbicides.

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